Netherlands Food and Consumer
Product Safety Authority
Ministry of Agriculture,
Nature and Food Quality

Quick scan National Plant Protection Organization, the Netherlands

Quick scan number: MYC 2021-001

Quick scan date: 21 June 2021

No.	Question	Quick scan answer for four new species in the *Neocosmospora ambrosia* species group
1.	What is the scientific name (if possible up to species level + author, also include (sub)family and order) and English/common name of the organism? *Add picture of organism/damage if available and publication allowed*.	This quick scan is for four new fungal species within the *Neocosmospora ambrosia* species group. These organisms were identified by the NPPO-NL as new species based on the analysis of the EF1a and rpb2 gene sequences obtained from the 684 bp and 1863 barcodes using the dataset described by Sandoval-Denis et al. (2019) and Lynn et al. (2020). These molecular results clearly show that these fungi are in the *Neocosmospora ambrosia* species group, but they are neither *N. ambrosia* (*N. ambrosia* (Gadd & loos) L. Lombard & Crous; family: Nectriaceae, order Hypocreales) nor *N. euwalaceae* (S. Freeman, Z. Mendel, T. Aoki & O'Donnell) Sandoval-Denis, L. Lombard & Crous nor any of the other known species in the group. The fungi were isolated from *Euwallacea fornicatus* s.l. insects and from mycelial tissue growing in bore holes and in the wood around bore holes of stems of *Ficus* spp. (see figure), *Annona* sp., *Bauhinia* sp. and *Artocarpus* sp.

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		 Figure: Fungi were isolated from wood showing brown discoloration around a bore hole of a *Euwallacea fornicatus* s.l. beetle © NVWA.
2.	What prompted this quick scan? *Organism detected in produce for import, export, in cultivation, nature, mentioned in publications, e.g. EPPO alert list, etc.*	A notification from Germany after a finding of *Euwallacea fornicatus* in a tropical greenhouse on plants delivered by a Dutch company prompted a visit by the NPPO-NL and samples of suspected material were collected; non-European Scolytinae were found. This also prompted inspections for *Neocosmospora ambrosia* and *N. euwallaceae* because these two fungi are symbionts of *E. fornicates* s.l. spp. and are proposed as quarantine organisms in the EU in the near future.
3.	What is the current area of distribution?	Unknown, the organisms had most likely been introduced in a greenhouse in the Netherlands with the import of (sub)tropical trees.
4.	What are the hostplants?	The host range is unknown; In the Netherlands, these organisms have so far been found on *Ficus* spp., *Annona* sp., *Bauhinia* sp. and *Artocarpus* sp.

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5.	Does the organism cause any kind of plant damage in the current area of distribution and/or does the consignment demonstrate damage suspected to have been caused by this organism? *Yes/no + plant species on which damage has been reported + short description of symptoms.* *Please indicate also when the organism is otherwise harmful (e.g. predator, human/veterinary pathogen vector, etc.).*	Possibly. These fungi were isolated from the larvae, adult beetles and bore holes of *Euwallacea fornicatus* sensu lato. *Neocosmospora* spp. within the *N. ambrosia* group form a symbiosis with *Euwallacea* spp. They facilitate the life cycle of their symbiotic beetles and are the food source for the adult beetles and larvae (Kasson et al. 2013, Eskalen et al. 2013; Freeman et al. 2013; O'Donnell et al.2015)). One member of the *N. ambrosia* group, *N. euwallacea*, grows in the woody parts of trunks and stems and cause blockages of the sap flow. This then causes wilting and die-off of branches and it could eventually potentially kill the tree (Kasson et al. 2013). Plant species/genotypes that are native to the area of origin of the beetle and the fungus may not suffer much from infections by the fungus but exotic species may do so. The combination *E. fornicatus* and *N. euwallacea* is causing major damage in avocado plantations and urban forests after their introduction in Israel, southern California and South Africa (Mendel et al., 2012; Eskalen et al., 2014; De Wit et al., 2021). There may be more fungi within the *N. ambrosia* group that can cause similar damage to plants as *N. euwallacea.* *Neocosmospora* species within the *N. ambrosia* group have also sporadically been associated with human mycetoma (Sandoval-Denis, 2019).
6.	Assess the probability of establishment in the Netherlands (NL) (i.e. the suitability of the environment for establishment). a. In greenhouses b. Outdoors c. Otherwise (e.g. storage facilities, human environment)	The probability of establishment of these fungi is tightly linked with the probability of establishment of its symbiotic vector: *Euwallacea fornicatus* s.l. Establishment of *E. fornicatus* after introduction in greenhouses with tropical trees is likely. The probability of establishment of *E. fornicatus* in outdoor or other environments in the Netherlands is assessed to be low, based on a minimum temperature for development of the beetle of about 15°C and absence of breeding populations above an altitude of 1400 in Sri Lanka with a mean temperature of 15°C (Walgama & Zalucki, 2007; Umeda & Paine, 2019). In de centre of the Netherlands (De Bilt), the mean daily temperature is on average (period 1991 – 2020) 10.5°C (10,7°C for Maastricht in the southeast) and only during three months the mean temperature is above 15°C (the same for Maastricht) (KNMI, 2021).
7.	Assess the probability of establishment in the EU (i.e. the suitability of the environment for establishment).	Establishment of *E. fornicatus* and thus the establishment of its fungal symbiont(s) is most likely in southern member states of the EU (EPPO, 2017).
8.	What are the possible pathways that can contribute to spread of the organism after introduction? How rapid is the organism expected to spread (by natural dispersal and human activity)?	The trade of host trees is the most likely pathway to contribute to rapid spread of these organisms. Natural dispersal of the vector *E. fornicatus* s.l. is mostly local over short distances (< 100 m) (Owens et al., 2019).
9.	Provide an assessment of the type and amount of direct and indirect damage (e.g. lower quality, lower production, export restrictions, threat to biodiversity, etc.) likely to occur if the organism would become established in NL and the EU, respectively?	*E. fornicatus* and its fungal symbiont *N. euwallacea* are causing major economic impacts in avocado plantations and urban forests after their introduction in Israel, southern California and South Africa (Mendel et al., 2012; Eskalen et al., 2014; De Wit et al., 2021). These impacts are also likely to occur in southern EU member states like France, Greece, Italy, Portugal and Spain if the beetle and fungus were to become established. In the entire EU, the vector – fungus combination may cause major damage in tropical greenhouses (e.g. in zoos, botanical gardens etc.). *E. fornicates* in combination with other fungal symbionts within the *N. ambrosia* group might cause similar damage (to other

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		trees species) if they were to become established. However, knowledge on this is lacking and the pathogenicity of the four new species is still to be established.
10.	Has the organism been detected on/in a product other than plants for planting (e.g. cut flowers, fruit, vegetables)? *If "no", go to question 12*	No
11.	If the organism has been found on/in a product other than plants for planting (e.g. cut flowers, fruit, vegetables), what is the probability of introduction (entry + establishment)? *Only to be answered in case of an interception or a find.*	-
12	Additional remarks	*E. fornicates* s.l. is a Union quarantine pest as all non-European Scolytinae are regulated as Union quarantine pests (Implementing Regulation (EU) 2019/2072, Annex IIA). *Neocosmospora ambrosia* (Gadd & Loos) L. Lombard & Crous and *Neocosmospora euwallaceae* (S. Freeman, Z. Mendel, T. Aoki & O'Donnell) Sandoval-Denis, L. Lombard & Crous have been proposed for listing as Union quarantine pests.
13.	References	De Wit M, Crookes D, Blignaut J, ZWd B, Paap T, Roets F, Cvd M & Richardson D, 2021. Invasion of the Polyphagous Shot Hole Borer Beetle in South Africa A Preliminary Assessment of the Economic Impacts. EPPO, 2017. Report of a Pest Risk Analysis for Euwallacea fornicatus sensu lato and Fusarium euwallaceae. [https://gd.eppo.int/taxon/XYLBFO/documents] Eskalen A, stouthamer R, Rugman-Jones P, Paine T, Coleman T, Na F, Lynch S & Sugino K, 2014. Fusarium dieback, an emerging exotic disease/pest complex causing dieback throughout agricultural, urban, and wildland landscapes in Southern California. Proceedings of the, Kasson et al. (2013). An inordinate fondness for Fusarium: Phylogenetic diversity of fusaria cultivated by ambrosia beetles in the genus Euwallacea on avocado and other plant hosts. Fungal Genetics and Biology 56, 147-157. KNMI, 2021. Klimaat van Nederland. Beschikbaar online: https://www.knmi.nl/klimaat Lynn KMT, Wingfield MJ, Durán A, Marincowitz S, Oliveira SS, de Beer ZW & Barnes I, 2020. Euwallacea perbrevis (Coleoptera: Curculionidae: Scolytinae), a confirmed pest on Acacia crassicarpa in Riau, Indonesia, end a new fungal symbiont; Fusarium rekanum sp. nov. Anthonie van Leeuwenhoek: https://doi.org/10.1007/s10482-020-01392-8 Mendel Z, Protasov A, Sharon M, Zveibil A, Yehuda SB, O'Donnell K, Rabaglia R, Wysoki M & Freeman S, 2012. An Asian ambrosia beetle Euwallacea fornicatus and its novel symbiotic fungus Fusarium sp. pose a serious threat to the Israeli avocado industry. Phytoparasitica, 40, 235-238

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		O'Donnell et al. (2015). Discordant phylogenies suggest repeated host shifts in the Fusarium–Euwallacea ambrosia beetle mutualism. Fungal Genetics and Biology 82, 277-290. Owens D, Seo M, Montgomery WS, Rivera MJ, Stelinski LL & Kendra PE, 2019. Dispersal behaviour of Euwallacea nr. fornicatus (Coleoptera: Curculionidae: Scolytinae) in avocado groves and estimation of lure sampling range. Agricultural and Forest Entomology, 21, 199-208. https://doi.org/10.1111/afe.12321 Sandoval-Denis M, Lombard L & Crous PW, 2019. Back to the roots: a reappraisal of *Neocosmospora*. Presoonia, 43, 90-185. Umeda C & Paine T, 2019. Temperature can limit the invasion range of the ambrosia beetle Euwallacea nr. fornicatus. Agricultural and Forest Entomology, 21, 1-7 Walgama RS & Zalucki MP, 2007. Temperature-dependent development of Xyleborus fornicatus (Coleoptera: Scolytidae), the shot-hole borer of tea in Sri Lanka: Implications for distribution and abundance. Insect science, 14, 301-308
14.	**Conclusions**	This Quickscan was prompted by the finding of four new fungal species within the *Neocosmospora ambrosia* species group. These fungi were isolated from larvae, adult beetles and bore holes of *Euwallacea fornicatus* s.l. in wood of (sub)tropical plants in a commercial greenhouse. Fungal species within the *Neocosmospora ambrosia* group are known as fungal symbionts of *E. fornicatus* s.l; they are not known to be spread by other Scolytinae. *Euwallacea fornicatus* s.l. and its fungal symbionts can likely establish in tropical greenhouses across the EU and outdoors in southern EU member states. It is unknown if *E. fornicatus* s.l. in combination with the four new fungal symbionts can cause economic damage.
15.	**Follow-up measures**	It is recommended to conduct research on the pathogenicity of the four new *Neocosmospora* species found.